DATA PROCESSING DIGEST

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General Information

AUTOMATIC CHARACTER READING FOR DATA PROCESSING SYSTEMS

Lowell H. Hattery, The American University
PUBLIC ADMINISTRATION REVIEW, Summer 1957; pages 159-163

The weakest link in an integrated electronic data processing system is the input. Punched tape, magnetic tape, punched cards, keyboards--all have the disadvantage of being intermediate, nonproductive steps. The need is for reliable methods of direct and automatic communication from original documents to the processor.

In reviewing the state of the art of character reading from source documents, this article states several problems.

Both equipment and input data must be based on standards established by equipment manufacturers and users. Much progress has been made in this problem area by the important recommendation of the American Bankers Association in July 1956 ((see DPD September 1956, pg. 7 and December 1956, pg. 8)), to adopt magnetic ink character recognition for check handling.

Reliability of character reading equipment and of the carrier itself is another problem. Both magnetic and optical scanning methods have their advantages and drawbacks. In the case of magnetic character scanning, surface smudging, scotch tape, overprints, and similar mutilations do not jeopardize the accurate reading of the characters. However, the ink must be held in close formula tolerances, and the printing must be uniform. Optical scanning does not require such close ink tolerances, but overmarking and obliteration destroys the accuracy of the reading. Some progress is being made in reducing the problem of overmarking, through the use of an original ink of high gloss.

One of the critical problems in automatic character reading is the successful mechanical movement of paper past a reading head at high speeds. A vacuum process has been designed which, it appears, can read successfully up to speeds of 1500 to 3000 items per minute.

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Cooperative action among manufacturers and users is doing much to further progress in this field. Equipment makers exchange information and discuss the problem through their trade association, the Office Equipment Manufacturers Institute. The Federal Government supports research through defence agencies and the Post Office Department (which is doing research on automatic sorting of letter mail).

Although there is a difference of opinion on the immediacy of equipment availability, management would be well advised to consider the possibilities in their initial studies for computer systems. "Optical scanning equipment is already in commercial use. It seems reasonable to expect that magnetic ink equipment will be commercially available within one to five years.... Therefore managements of large data processing programs should assign some staff time to appraising current developments and their possible usefulness to the organization. Little is known yet about the economics of character reading and this is one of the areas to which staff attention should be given."

NINE GUIDEPOSTS IN SELECTING A BUSINESS-DATA PROCESSOR

Peter James, IBM Research Center, Yorktown, N. Y.
CONTROL ENGINEERING, January 1958; pages 108, 109

"A general-purpose machine can easily be too general for many applications.... Careful analytic comparison of job and machine is... the only correct approach."

Computer selection should be based on the following points:

Find the right computer for your use

1. Volume of storage, 2. Frequency of transactions, 3. Computations required, 4. Data flow pattern, 5. How data is composed, 6. Length of processing runs, 7. Amount of reference to files, 8. Equipment costs. Nine rules are given for general observance:

1. Get unbiased outside advice for special problems.
2. System checks should complement the machine's built-in checks to assure as high a degree of accuracy as necessary.
3. The type of input-output medium fixes the overall processing speed.
4. Avoid conversion from one medium to another.
5. The system with the fewest conversions is the most efficient.

6. Avoid superfluous equipment.

7. When production runs are the rule, magnetic tape is the best medium since it provides the fastest transmission.

8. Consider the advantages and disadvantages of functional utilization in equipment for probable future expansion.

9. Don't wait for a better machine

INSTALLING ELECTRONIC DATA PROCESSING SYSTEMS

Richard G. Canning, Canning, Sisson and Associates, Los Angeles, California
Published by John Wiley and Sons, Inc., 1957. $6.00

Reviewed by R. B. Curry, Comptroller, Southern Railway System

The dollar magnitude of an electronic data processing system is so great that management can no longer remain aloof from the details and must be actively concerned with the problems involved. It is not easy to predict all of the problems in a new field, but many difficulties can be foreseen if trouble is taken to think ahead of time. This is the theme of Canning's new book for top management reading.

The present book was written to follow the author's previous book, "Electronic Data Processing for Business and Industry," which was concerned with the planning period prior to the placing of an order for a computer. This book begins with the placing of the order and covers:

1. Planning the installation program
2. Programing
3. Installation
4. Conversion to EDP system
5. Early phases of operation

Installation plans are top management responsibility

While the emphasis is toward top management, it is certainly a practical and informative book for all levels of management. It is not a rehash of old material, a device frequently employed by writers ir this field. Canning has succeeded in preparing a practical and useful guide for management. The author has demonstrated that a computer is primarily a management tool to be used as part of the larger concept of a Management Improvement Program.

In too many instances, top management has been satisfied with learning the "general concepts" of EDP and turning the problem of planning and installation over to the "specialists." This attitude, Canning points out, can lead to some very costly mistakes, since there is nothing inherent in EDP machines which assures their efficient use. Success depends much more on people than it does on the machines, and the rela-

tive advantages of the different makes of equipment are secondary to the methods by which this equipment is used.

A case study shows how

The case method is used to demonstrate the problems. A manufacturing firm is the mythical company selected for this study. However, this case is a composite of the experience of several types of companies and the material has been so generalized that it is not limited to applications which would be of interest only to the management of a specific industry.

The book starts with a chapter on management's responsibilities and discusses the organization of its EDP program, selecting the individual to head up this operation and selecting the staff. Methods are also reviewed for laying out budgets and time schedules. Subsequent chapters deal in a practical manner with the development of detailed procedures for the EDP operations, beginning with system plans, training personnel and carrying through to coding for the computer. The methods demonstrated for charting the jobs to be done and the personnel requirements for doing these jobs are especially useful. Other chapters deal with the problems to be considered for the physical installation of the equipment, an area frequently overlooked by other writers. The book continues with details of program clean-up and the conversion of operations over to the electronic system, followed by the operation of the electronic system on a productive basis.

INFORMATION SYSTEMS IN DOCUMENTATION

Editors: Jesse H. Shera, Allen Kent, James W. Perry
Published by Interscience Publishers, 1957. $12.00

Tools of documentation

The papers of the 1957 Symposium on Systems for Information Retrieval are published in this volume of 639 pages. The papers describe and demonstrate "systems ranging all the way from those based on traditional library techniques principally involving the arts of card-indexing and classification through applications of punched cards and mechanical sorting based on machine coding to prospective applications of photography, telecommunication, telefacsimile and computer-like mechanisms, separately or in combination." These are presented as case studies of actual applications.

Both librarians and library users realize the difficulties involved in documenting and retrieving literature. But although "the techniques and mechanisms used in information-retrieval are no less tools than are lathes, presses, centrifuges, and microscopes..." we do not know the "measure of their capacity for work and of their efficiency with respect to particular operations." For example, "what...are the capacities and limitations, under various conditions, of marginally punched cards, of machine-sorted cards...? The fact is that we do not as yet even have a language in which we can express these various capacities and limitations...."

The papers are divided into six sections: fundamentals in system design, documentation problems in specialized fields, semi-automatic systems, systems using accounting or statistical machines, systems using computers or computer-like devices, and cooperative information processing. Author and subject indexes are included.

CASE STUDIES IN INDUSTRIAL MANAGEMENT

J. M. Juran and Norman N. Barish
Published by McGraw-Hill, 1955. $5.75

This case study which has just come to our attention, should prove to be of interest to those of our readers who would like to learn more about the variety of paperwork that goes on in a complex industrial organization. This book is very simply written and profusely illustrated. A typical page, for example, contains two paragraphs of writing which pertain to the illustration. The illustration (usually a picture of a partially completed form or report page) takes up most of the page.

Information flow is described through forms study

The authors have chosen to analyze the Burndy Engineering Company in some detail. Over 100 employees of Burndy were interviewed. The company manufactures, among other things, small but complex hand tools. The authors have analyzed many of the major problems facing Burndy's management, including product development, plant location, manufacturing planning, plant layout, production control, cost control, and others. The book gives a good picture of the entire business.

From a data processing standpoint, the sections on production control, inventory control, and cost control are quite interesting. The flow of information in these activities is traced through the medium of the forms used by Burndy. The concepts are easily grasped by means of the illustrations used.

It would seem that this book would fill a need existing in many EDP groups, where the systems analysts and programers have been selected on the basis of their logical ability, but whose business background is limited. It should be especially appropriate as training literature for EDP groups in manufacturing firms.

Management Decision-making Techniques

TOP MANAGEMENT DECISION SIMULATION — THE AMA APPROACH

*Published by American Management Association, 1957. $4.50**

Modeled after the war games, the AMA management decision game has been designed "to provide conditions under which a few hours of concentrated decision-making--under pressure--will equal years of actual experience." In a slim volume of 126 pages, the authors have presented the story of the AMA management decision game in six general sections: problems of management decision making, methods for solving management problems, creating a model, playing the game, use of the computer, and an analysis of the game's value.

Problem-solving by model building

In Part I, the problems of top management decision-making are stated, and some methods are given for problem solving by mathematical techniques. The inadequacy of mathematical tools is then explored. To overcome this inadequacy one builds a "model" which may describe an operation, and then tests the description by testing the model. This is called "simulating" a system.

Part II describes the development of the AMA Game, inspired by the war games conducted by the Armed Forces. A step-by-step description of the design process is given, beginning with the purposes of the game, the principles upon which the design was based, and practical considerations of the design requirements for achieving the purpose. A list of 20 decision areas was developed, from total marketing effort to make-or-buy problems. From this list, four were selected--production, marketing, research and development, and expansion of production capacity through capital investment--around which to design the game.

Because of the dynamic quality of business decision-making, it is impossible for the game to have a "winner." Therefore, it was necessary to consider the evaluation period following the game-playing, in order that the participants might gain from group discussions on their plays. To aid in the discussion period, a series of control charts was devised, to be kept by the staff, and revealed to the players for the first time during the evaluation.

Two chapters are devoted to the actual method of playing, and to the role of the computer in processing and reporting the plays. The final chapter evaluates the game in terms of its usefulness, and its possibilities for future expansion of the gaming idea. "At the present time....AMA's game does <u>not</u> offer a simple new mechanical tool for

making correct decisions without the exercise of good business judgment.... But it certainly suggests the possibility that simulation someday may have even broader uses as a means of mapping out solutions to problems before they arise...."

((See also: DPD: Comment, "Management Gaming," January 1958, pg. 10.)) *Price to members: $3.00.

REPORT TO THE EIGHTH AIIE NATIONAL CONFERENCE ON THE SYSTEM SIMULATION SYMPOSIUM

Warren E. Alberts, United Air Lines, Chicago, Illinois
JOURNAL OF INDUSTRIAL ENGINEERING, November-December 1957; pages 366-369.

A symposium on simulation was held by 20 of the top men in simulation, on an invitational basis. Discussions centered around simulation studies of an air defense system, Air Force Logistics System, Strategic Air War, bus terminal operation, airline ticket counter, inventory and production scheduling, and the AMA management game.

Simulation definitions and advantages

The report defines a system model as "a symbolic representation of a system which has, for a given purpose, the desired characteristics of reality. System simulation "is simply the use of a system model to reproduce the essence of actual system operations." The kinds of models are: (1) "the physical or visual model which looks like what it represents and is exemplified by a map, a proto-type of a new aircraft, or the layout of your new plant"; (2) "an operational or analog description...a straight-forward, logical step-by-step sequencing of operations as they exist in real life"; (3) "an analytical model [whose] interactions can be stated in mathematical form." Although "workers in the model field seek to express a system in an analytical form...in real life there are often so many variables and probabilities to be handled that the means to handle this in an analytical form, plus having it understood by the people who are going to have to work with it, has not been developed."

As to why business men or management scientists should be interested in simulating a system, four reasons are suggested: (1) For purposes of experimentation or evaluation; (2) To learn more about the system in order to redesign or refine it; (3) To familiarize personnel with a system or situation; (4) To verify or demonstrate a new idea or system.

Some of the advantages of simulating are: (1) Simulating a system enables one to compress or expand real time; (2) the business man can test ideas and changes before putting them into effect.

A research report on the Symposium is available from the AIIE Headquarters, 145 North High Street, Columbus, Ohio. Price: $1.75.

Applications

EDPM INVENTORY CONTROL

R. D. Benson, General Electric Co., Richland, Washington
SYSTEMS AND PROCEDURES, November 1957; pages 6-15

Four-phase changeover to new system

An inventory system for maintaining 20,000 items is described in detail. The conversion from manual posting to the IBM 702 system was done gradually in four phases. During the first phase, stock issues were punched into tab cards, then quantity on each issue was multiplied by the unit price contained on a master tape. The computed values were printed out and compared with results of manual posting. During the second phase weekly summary posting was done from the computer-prepared report. In the third phase, all transactions were done on the computer in parallel with the manual method, and the results were compared. Finally, in the fourth phase, the manual posting was eliminated.

A chart shows the transactions processed by the system as follows: (1) Maintain stock balance position on each line item; (2) Develop one year's usage history; (3) Extend issues for cost distribution; (4) Establish reorder points and quantities; (5) Prepare Demand Analysis Report monthly; (6) Create updated Master Record. These functions are explained in a description of three reports designed for computer output: one to tell when and how much to order (Reorder Analysis), the second to provide an audit trail (Activity Listing), the third to provide a means of reviewing disbursement history (Demand Analysis).

The Reorder Analysis suggests a recommended order quantity (computed by an equation described in the article) and a resume of disbursement action for the past twelve months. "As an item is reported for reorder review, three tabulating cards are prepared. These cards, prepunched with item and class number, unit of issue, and transaction code, accompany the Reorder Analysis report and are used as follows:

"Due-In: As each item is ordered, the corresponding due-in card, prepunched with the recommended order quantity is re-entered into the system. It sets up the due-in quantity in the master record....

"Receiving Card: The purchase order number is entered on the receiving card and forwarded to the receiving operation. Upon receipt of the material, the quantity received is entered on the card along with the total value of the shipment....From the receiving transaction, the machine picks up the dollar value of the receipt and the quantity in terms of the unit of issue, computes a new unit price and lead time, reduces the due-in quantity, and computes a new Economical Order Quantity position for the item. The results...are recorded in the master record.

Three output records

"On Order Card: The On Order Card is used as a desk reference...and is destroyed when the order is received."

The machine is programed to edit data, rejecting and reporting transactions that are in apparent error.

The Activity Listing is a weekly listing "showing the opening position of each item in the inventory including date of last activity, balance on hand, due-in, back-ordered, unit price, inventory value, lead time, economical order quantity, average use, and maximum quantity....

"During the debugging phase and in the initial weeks of the conversion, this report was referred to frequently, to verify the effect of detail activity on the master record." Subsequently, it reverted to its original use, "as an audit trail and an occasional reference source to be used when suspected error situations appear."

The Demand Analysis report is a two-line report in which the first line "identifies the item and shows the old and new average usage along with a frequency distribution of the number of issues and quantity for the period being reviewed. The second line presents a recap of disbursement transactions by month for the past year."

An interesting aspect of the system is the provision made for substitute transactions. "In those cases where an item is substituted for one that is out of stock, it is important not to distort usage history by increasing demand on the substituted item. In such cases, two transaction cards are created. One entered for the item disbursed, reduces the balance on hand but does not increase usage history. The second card entered for the out of stock item, adds quantity to the usage history field, but does not affect balance on hand."

Controls are built in

To protect against undetected machine or program errors, a "relatively simple internal machine control was developed....

"The input and output master tapes are created with control records following each inventory class (about 29)....Each time an input master record is read into memory, control totals are accumulated from selected fields....As detail transactions are read into memory that affect the selected fields, the net change is accumulated in a separate group of 'counters.' Also, as the updated master is written, the same selected fields accumulate in a third set of 'counters.' When a control break is reached, the accumulated input master totals are compared to the input master control record--these totals should agree. Next, the net result of the detailed transactions are added to the master input totals and the result compared to the accumulated output master totals. These totals should also agree--they become the new control record which is written onto the output master tape....

"In a separate editing pass that runs about 15 minutes, the updated master tape is read and the selected fields are accumulated

and balanced to the control records. In this manner the input master to the next reporting cycle is proved accurate.

"The accumulated control totals are printed by the machine as the comparisons are made. The results are maintained by control personnel who add one more check to the system by comparing beginning and ending totals from the preceding report period."

The file of 20,000 items, 430 characters each, is stored on one and a half reels of magnetic tape, compared with the 300 square feet of floor space occupied by the old inventory files. The program phase of the system required approximately 5000 handwritten instructions and was programed and debugged in about five man-months. The inventory is processed, excluding auxiliary printing time, in five hours.

RAMAC AT WORK

Willard L. Jerome and Mrs. Loretta Hartford, Square D. Co., Milwaukee, Wisconsin
SYSTEMS AND PROCEDURES, November 1957; pages 30-38

The Square D Company was offered a test model of the IBM 305 RAMAC. The company accepted the offer and began to program for a material control application. Since the expected delivery time of the test computer was only three months away, the company did not have time to revise its present punch card system, but instead, programed the system for the computer, including the exceptions as well as the normal routine.

Part numbers are indexed

Records for 24,000 parts are all on disk storage. The cumbersome 17-digit part numbers were reduced to 4-digit addresses, located through an index number on each track of the memory. Inputs consist of bill of material decks of punch cards, and miscellaneous transaction cards. About 250 bills of materials and 1000 miscellaneous cards are processed each day, in the following types of activities: 1. Extend unit quantity of each component; 2. Bring stock status totals up to date; 3. Punch order requests; 4. Print material lists; 5. Reproduce cards for parts controlled outside the material control procedure; 6. Control the decks; 7. Control the documents; 8. Type out erroneous records for investigation. A maintenance program was diagramed to load the records in memory, make any changes necessary in the usually unchanging parts of the record, delete obsolete records and make space available for re-use, unload selected records, mass unload entire file twice a month for audit trail.

Square D estimates that the production version of the RAMAC will process the material control application in about 2-1/2 hours a day.

OFFICE AUTOMATION APPLICATIONS

R. Hunt Brown, Automation Consultants, Inc., 1957

Updating service

"Office Automation Applications" is a reference manual, on the current status of electronic data processing applications. It has an up-dating service similar to the author's previous book, "Office Automation," which will increase the value of the book as applications of electronic office equipment become more numerous and of higher quality. A look through those portions of the loose-leaf book which contain case histories reveals the paucity of truly well-designed electronic data processing systems presently in use. Most of the studies are well written and presented, and profusely illustrated with photos of equipment and installations and with charts, diagrams and drawings.

Applications are divided into eight categories of companies: Manufacturing: Durable Goods; Manufacturing: Non-Durable Goods; Petroleum Products; Finance and Insurance; Retail and Wholesale Trade; Government; Services and other categories. Of these, the majority are using an IBM 650 without magnetic tape. Other equipment represented includes Univac I, IBM 305 RAMAC, Datatron, Univac File Computer, IBM 702 and 705, and some smaller special equipment. Applications include inventory control, payroll, various insurance and banking functions, utility billing, reservations, subscription fulfillment. Many of these applications are conventional IDP systems.

Because of the great difference in the quality, completeness, and length of the case studies, it is impossible to choose a "typical" study to describe as an example. We have chosen one of interest to describe, briefly: "The Functional Block Approach to EDP."

An example of a case study

This is a case history of the IBM 650 and 705 installation at the Equitable Life Assurance Society of New York. The study is seven pages in length, includes two flow charts of parts of the 705 programs, a flow chart of the calculation of a dividend rate, and a photograph of the computer installation. The case history describes the functional block approach taken by the company.

"Starting first with the Ordinary branch of the business, a series of 'blocks' was mapped out, each representing a major functional area and each embracing a large volume of work. It was decided that at some future time these blocks would be integrated into a single system, having as its heart a master tape file." Four of these blocks have been put into operation, and one of the four is described in the case history. The study also includes short sections on structural reorganization resulting from the EDP system, procedures for converting records, and a summary and evaluation.

"Office Automation Applications" is priced at $37.50 for the book, and $37.50 for one year's up-dating service. These prices are for the U.S.A. and Canada, only. Foreign rate is $42.50

Equipment

GAMMA 60

French computer

Our European readers, especially, will be interested in the newly announced Gamma 60 computer manufactured by Compagnie des Machines Bull of Paris, France. The system is an electronic computer with a core memory of from 16,000 to 128,000 characters depending upon the user's requirements. Addition time is 50 microseconds.

As input equipment, the system can have a 200-characters-per-second paper-tape reader and a 300-cards-per-minute punched-card reader. As output, Bull claims a 300-cards-per-minute punch. A 25-characters-per-second paper tape punch and a 300-lines-per-minute printer are also available.

For large volume memory, magnetic tape units are supplied. These operate at 8000 characters per second with rewind at a higher speed. A reel of tape holds 5 million characters. An auxiliary drum is available, holding 130,000 characters with an average access time of 11 milliseconds.

The internal design of the computer is made very flexible by having independently operating comparison, arithmetic, input, and output units. Thus, searching (for example), conditional comparisons, and arithmetic operations can, to some extent, proceed in parallel.

Computers of smaller sizes also apparently are available in the Gamma series.

IBM CHECK-PROCESSING SYSTEM

Working model of check-processing equipment

The electronic system for check-processing under experiment at the IBM Product Development Laboratory has been publicly demonstrated. The system as shown will not be marketed, but is being built and operated for the purpose of gaining experience in banking systems. The market version of the equipment will incorporate the placing of magnetic Arabic characters on the bottom edge of the check, as recommended by the Technical Subcommittee of the American Bankers Association.

The system has two units for processing checks of random size and paper thickness. The inscribing unit places identification and

amounts on checks in magnetic ink. The sorting unit sorts checks into the data processing system. These two units were used in the demonstration with an IBM 650 RAMAC.

Batches of incoming paper and card checks were forwarded to the operator at the check inscriber unit. On the operator's control panel, batch numbers and dates had been preset for repeat printing on every check. The operator took a check and keyed in the amount on the keyboard. She then inserted the check into the check slot, and at a touch of the motor bar, the check was sent into position, and the amount was automatically printed on the check in a special magnetic ink. A transport mechanism aligned the checks automatically for absolute registration and quality impression of the magnetic printing. The inscribing operation could be performed at speeds up to 3000 checks an hour, depending upon the operator's dexterity. At the end of each batch of checks, a total was automatically printed on an adding machine tape for balancing to previously established controls.

The batch of checks, now containing in magnetic ink all the information necessary for posting to customers' accounts, was next taken to the check sorting and reading unit. The operator fed the batch into the machine, which separated the checks into two groups--"Package-posting Accounts" for business accounts and "Personal Accounts"--to provide maximum flexibility in posting. Simultaneously, all the information in magnetic ink on each check was read, and a standard IBM accounting machine was activated to prepare a register of all items distributed to the two groups. This register balanced all checks to pre-established controls and set up new totals to control subsequent posting.

Changes are posted to the disc storage records

To post personal accounts, the checks previously sorted into the "Personal Account" group were placed in the hopper of the sorter-reader still in random account sequence. All information on the checks was read by the machine and transmitted to the 650 for automatic posting to the accounts stored in the disk storage file.

The RAMAC sought the account records stored on the magnetic disks and immediately posted the proper accounts with current transactions, automatically detecting any overdraft, stop payment or hold, and accumulated information for calculation of service charges. At the same time, the 407 Accounting Machine recorded each posted transaction in a journal and listed the date of last previous entry and overdrafts, stop payments and holds on an account. In the demonstration, using the electric typewriter at the inquiry station, the operator was able to ask for account status at any time and obtain an immediate typed record of the entire account--without impeding the process of account posting.

Following posting, the batch of personal checks was again placed in the sorter-reader for automatic sorting to account sequence for filing until time to render statements. Customer statements were automatically prepared from the checks.

((See also: DPD May 1957, page 10 and October 1957, page 14.))

MAGNETIC TAPE RECORDING FOR COMPUTER USE

Edward G. Wildanger, Ampex Corp.
AUTOMATIC CONTROL, December 1957; pages 36-40

There are at least five criteria for magnetic tape equipment used in an electronic data processing system. These are: reliability, dependability, high performance, ease of operation, and low maintenance requirements and ease of servicing.

Some of the problems which have prevented achievement of the ideal tape system are "dropout" (a momentary loss of the recorded signal when it is being reproduced), inconsistent pulse resolution, and "skew" (tape moving diagonally across the heads because of imperfect tape guiding).

"Performance in a magnetic-tape system depends upon all the components from input to output. The tape transports, heads, electronic assemblies, and tape are all equally important. The only way to achieve optimum results is to view the recording equipment as a system. Problems arise when components manufactured by a variety of sources are used together....However, using the system approach, results can be improved considerably.... The system philosophy is the keystone of the digital program to improve magnetic-tape recording for data controls."

PACKING DATA PULSES AT 300 BITS PER INCH

AUTOMATIC CONTROL, December 1957, page 43

Ampex Corporation is now producing a digital computer input/output magnetic tape system with transfer rates up to 90,000 six-bit characters per second. The one-inch magnetic tape has a packing density of 300 bits per inch. This will give the user faster transfer rates, greater computer productivity, less search time, more economical use of the initially more costly but longer-lived computer tape, and a greatly reduced need for buffer storage. The system includes Ampex' own magnetic tape to increase the compatibility of the system's components. Each reel is individually pretested against rigorous noise and dropout standards.

HIGH SPEED ALPHANUMERIC PRINTER

Potter Instrument Company has designed a new high speed alphanumeric digital printer, Model 3260. The printer can print more than 400 digits or characters per second, up to 40 columns wide.

Numerical Control

((Although DPD does not cover numerically controlled machine tool articles exhaustively, we do try to keep up with the field and bring you articles which present management's problems in the use of these devices, and which show how computers become involved. This month several articles have appeared which, together, present a good review of the use of tape controlled tools.))

THE DOLLARS AND SENSE OF NUMERICAL CONTROL

TOOLING AND PRODUCTION, December 1957; pages 89-98

"Numerical control is basically a...concept adaptable to a specific machine tool and should not be confused with automation...." Numerical control applies to quantities under mass production, i.e., for job-shops typical of 55 to 65% of production in the U.S. The benefits include greater accuracy, fewer inspections and an alleviation of the skilled operator shortage. Shorter lead time, set-up time and a full 8-hour day are important benefits.

Two classes: positioning and contouring

There are two classes of control: Class I, called "Positioning," and Class II, called "Contouring." The class most widely used and most applicable to a general job-shop is Class I, wherein an electronic control moves the machine's table to various positions referenced from a specific point. It can be used for drilling, tapping, boring, riveting and grinding, etc. Automatic position and tool-changing have been accomplished (but not, as yet, full control of a line). Savings of 30 to 50% over standard methods are estimated.

"Programming requirements (getting everything ready for the actual machining) for Class I can involve a $200, or less, portable tape punching tool that is small enough to be held in one hand, very little training if any necessary and a 30 min. time expenditure." Data is punched from a simple modification of standard prints, but "the use of a drawing as we know it is being seriously questioned." Programing involves: preparing a step-by-step process sheet from a drawing, typing the steps on a special punch or typewriter and placing the tape thus prepared into the machine. The basic investment in a Class I tool is low as "Class I numerical control does not need a computer." One controller for a jig borer is about $13,850.

"The main difference in a contouring operation is the addition of a computer and its associated coding....The primary purpose of the computer...will be to plot the necessary points along the desired path of the cutter" between specified end points. This involves instructions or sub-routines previously loaded into the computer, and information pertaining to the present problem--the coordinates, the cutting

Class II is controlled by a computer

tools data and tolerances. Computers can also provide the best feeds and speeds, given material characteristics. As to the specific computer required, "it is a know fact around engineering circles that any general accounting office type of computer can handle the job of interpolating points along a curve." The case is mentioned of "a company that wanted numerical control but the company policy would not permit the purchase of another computer--so the manufacturer called its computer unit by a different name and closed the sale." ((Compatibility of tapes is a problem if the computer designed to go with the tool is not used.)) Computers and related components for numerical control systems range from $50,000 to $750,000 ($50 to $500 per hour). Programing services for numerical control are available from at least one company.

"With proper cost planning, the break-even point will range between 2 and 25 pcs" in Class II control. "Numerical control is engineer centered and benefits [from this include] placing of the final responsibility on the engineer and not on the machine operator."

Some problems in numerical control

Some of the problems in numerical control are: Maintenance, standardization ("Standardization studies in numerical control electronics is very important...especially in a large firm where machines of several different types could be controlled from one data processing room."), tool changing, wear and breakage, and labor ("Labor will not take to any concept that reduces manpower.... The worker trend is still in two directions...toward...technical specialty or 'chip-carrying' duties.... [The worker's] 8-hr day may seem longer and more boring...in contrast with the greater responsibility he assumes on the more complex and costly machine."). Applications of numerical control...to a well-established processing scheme for materials will require radical changes in operation.

Principal savings are in lead time reduction and fewer man-hours. In machining a die, for example, savings were 26% in layout, 55% in machining time, 50% in handwork, and 75% in inspection. For a cam, lead time was reduced from two to four months to less than one week. "Numerical control is here, it is good, and it shall enter industry on a much greater scale; also there is a great need to educate industry in the truths of the new system."

THE ECONOMICS OF WORK PERFORMED ON A NUMERICALLY CONTROLLED MACHINE TOOL

Thomas V. Atwater, Jr., Product Development Corp. and Robert H. Gregory, M.I.T.
JOURNAL OF INDUSTRIAL ENGINEERING, November-December 1957, pages 337-352

This evaluation of the economics of a numerically controlled machine tool is based on ten aircraft-type parts actually produced in small quantities (1-50) on a numerically controlled milling machine at the Servomechanisms Laboratory of M.I.T. ((Class II)). Although duplicate parts were not made under cost controlled conditions by

standard methods, estimates of making the parts in existing shops were obtained by getting estimates from qualified machine shops. The estimating procedure was examined and is believed to give reasonably good estimates of actual costs.

Make-ready and machining costs

The costs can be divided into make-ready and machining costs. For a numerically controlled machine, make-ready consists of (1) fixture design and production (similar to normal methods), (2) programing or determining tool motion required to product the part (possibly using an electronic computer), and (3) preparation of the paper or magnetic tape which will control the machine.

The cost studies indicated that "there is an excellent chance that one firm or more, in each geographical area providing a substantial volume of metal-working contract work, could operate profitably utilizing the Laboratory's numerically controlled milling machine as it stood in 1954 without any technical alterations, but with, probably, some improvement in make-ready costs...." The study showed that make-ready costs in the Lab were less than in existing shops for three of the ten parts, and less than some estimates of existing costs in five of the ten cases. Machining costs for 30 pieces were less than any other estimate for four parts and less than some estimates for seven parts of the ten. In general, make-ready costs were high, however.

Evidence that make-ready costs can be reduced is given by reference to a computer processing routine ((automatic program)) which simplifies the programing for a numerically controlled tool. The time to prepare data to make one part was reduced from eight hours manual processing to less than 15 minutes on the computer. Industry can reduce the Laboratory's high make-ready costs "since numerical control techniques are now in limited but promising production use."

THIRTY-ONE NUMERICALLY-CONTROLLED POINT-TO-POINT POSITIONING SYSTEMS

CONTROL ENGINEERING, January 1958 and subsequent issues

A detailed description of 31 numerically controlled positioning (Class I) systems begins in this issue in a special section.

CORRECTION

The article titled "Much 'Soul Searching' Involved in Applying EDP to Credit Function," by Chester A. Swanson, which was reviewed in the November 1957 issue of Data Processing Digest, page 7, originally appeared in Journal of Machine Accounting, August 1957, not in Computers and Automation as stated.

Comment

A SECOND READING LIST

A year ago DPD published its choice of reading material for a beginning study in electronic data processing. Five of the references have been retained and are included with the selections from 1957 material. All of the references have been reviewed or abstracted in Data Processing Digest. The hyphenated numbers at the end of each reference give the volume, month, and page, in that order, of the issue in which the review or abstract will be found. Included in the References on page 20 are the addresses of the publishers to help you obtain those items of interest to you.

A basic list for EDP study

The publishers of DPD have selected this material for persons who wish to begin the study of EDP or who wish to review what they have learned in the past. There are undoubtedly many excellent selections which do not appear on this list. However, we believe that this group will provide a basic understanding of the electronic data processing field for those who wish to pursue a personal program of study.

GENERAL INFORMATION

Electronic Data Processing for Business and Industry
Richard G. Canning; John Wiley & Sons, 1955. (2-4-7)

Office Work and Automation
Howard S. Levin; John Wiley & Sons, 1956. (2-6-4)

What to Consider When You Buy EDP
Charles E. Faulkner; Control Engineering, Nov. 1956, pg 92. (3-1-5)

The Auditor Encounters Electronic Data Processing
Report prepared by Price Waterhouse & Co. (3-4-1)

Business Electronics Reference Guide
Controllership Foundation, 1956. (3-4-10)

Administering a Conversion to Electronic Accounting
Harold Farlow Craig; Harvard Business School, 1955 (3-4-6)

Office Equipment: Buy or Rent?
Robert N. Anthony and Samuel Schwartz; Management Analysis Center, Inc. (3-8-7)

False Starts in Office Automation
John Diebold; The Management Review, July 1957, pg 81. (3-10-2)

Installing Electronic Data Processing Systems
Richard G. Canning; John Wiley & Sons, 1957. (4-2- 3)

Can You Afford the "Practical" Approach to Electronics?
R. R. Ross; Management Methods, Nov. 1956, pg 36 (3-1-1)

Helping to Put Electronic Equipment to Work for Business
Paul W. Pinkerton; NACA Bulletin, Jan. 1957, pg 626 (3-2-1)

Company Investigations of Automatic Data Processing
Peter B. Laubach; Harvard Business School, 1957. (3-4-6)

Integrated Data Processing for Every Office
H. John Ross; Office Research Institute, 1957. (3-6-1)

Technique of Systems and Procedures
H. John Ross; Office Research Institute. (3-10-3)

Never Overestimate the Power of a Computer
Ralph F. Lewis; Harvard Business Review, Sept.-Oct. 1957, pg 77. (3-10-4)

What Management Doesn't Know Can Hurt
Perrin Stryker; Fortune, Nov. 1957, pg 153. (3-12-1)

EQUIPMENT

Office Automation (and Updating Service)
R. Hunt Brown; Automation Consultants, Inc., 1955 and contin. (1-11-7)

APPLICATIONS

Computerized Production Control
Factory Management and Maintenance, July 1957, pg 84. (3-8-9)

Airline Automation: A Major Step
C. E. Ammann; Computers and Automation, Aug. 1957, pg 10. (3-10-10)

PROGRAMING

Program Control Techniques
Mrs. Frances Holbertson; The Programmer, Sept. 1956, pg 4. (3-2-9)

The Importance of Program Maintenance
John Boccomino; Systems and Procedures, Aug. 1957, pg 9. (3-11-1)

Tape File Maintenance
John H. Hughes; The Programmer, July 1957. (3-12-10)

Digital Computer Programing
D. D. McCracken; John Wiley & Sons, 1957. (3-7-13)

Automatic Coding Symposium--Franklin Institute
Computing News, Aug. 15, 1957. (3-10-13)

MANAGEMENT DECISION-MAKING TECHNIQUES (OPERATIONS RESEARCH)

O. R.--New Aid to Making Business Decisions
Peter Spooner; Business, April 1957, pg 69. (3-7-1)

Proceedings of the Conference on Operations Research, Computers, and Management Decisions (See paper on case study of Cummins Engine Co.) Case Institute of Technology, 1957. (3-11-3)

Introduction to Operations Research
C. West Churchman, Russell L. Ackoff, and E. Leonard Arnoff; John Wiley & Sons, 1957. (3-3-8)

Allocation of Sales Effort in the Lamp Division of the General Electric Company
Clark Waid, Donald F. Clark, Russell L. Ackoff; Operations Research, Dec. 1956. pg 629. (3-8-1)

A Manager Appraises Operations Research
R. A. Norman; Journal of Industrial Engineering, May-June, 1957, pg 173. (3-9-1)

References

The addresses of publishers and periodicals mentioned in this issue of DATA PROCESSING DIGEST are listed below for your convenience in obtaining further information about the articles or books listed.

American Management Association
1515 Broadway, Times Square
New York 36, New York

Automation Consultants, Inc.
155 Fifth Avenue
New York 18, New York

Automatic Control
430 Park Avenue
New York 22, New York

Business
Mercury House
109-119 Waterloo Road
London SE1, England

Case Institute of Technology
Cleveland 6, Ohio

Computers and Automation
815 Washington St.
Newtonville 60, Mass.

Computing News
12805 - 64th Avenue South
Seattle 88, Washington

Control Engineering
330 West 42nd Street
New York 36, New York

Controllership Foundation, Inc.
Two Park Avenue
New York 16, New York

Factory Management & Maintenance
330 West 42nd Street
New York 36, New York

Fortune
540 North Michigan Avenue
Chicago, Illinois

Harvard Business Review
Soldiers Field Station
Boston 63, Mass.

Harvard Business School
Soldiers Field Station
Boston 63, Mass.

Interscience Publishers, Inc.
250 Fifth Avenue
New York 1, New York

Journal of Industrial Engineering
225 North Avenue, N. W.
Atlanta, Georgia

Management Analysis Center, Inc.
275 Newbury Street
Boston 16, Mass.

Management Methods
22 West Putnam Avenue
Greenwich, Connecticut

Management Review
1515 Broadway, Times Square
New York 36, New York

McGraw-Hill Book Co.
330 West 42nd Street
New York 36, New York

N. A. C. A. Bulletin (now N. A. A. Bulletin)
505 Park Avenue
New York 22, New York

Office Management
212 Fifth Avenue
New York 10, New York

Office Research Institute
P.O. Box 744
Miami 43, Florida

Operations Research
Mt. Royal and Guilford Ave
Baltimore 2, Maryland

Price Waterhouse & Co.
56 Pine Street
New York 5, New York

The Programmer
Computer Publications Dept.
Remington Rand Univac
315 Fourth Avenue
New York 10, New York

Public Administration Review
6042 Kimbark Avenue
Chicago 37, Illinois

Systems and Procedures
4463 Penobscot Building
Detroit 26, Michigan

Tooling & Production
1975 Lee Road
Cleveland, Ohio

John Wiley & Sons, Inc.
440 - 4th Avenue
New York 16, New York

DATA PROCESSING DIGEST is published each month by Canning, Sisson and Associates, 1140 South Robertson Blvd., Los Angeles 35, California. Subscription rate: $24.00 per year. Foreign postage (exclusive of Canada and Mexico): $2.50 additional. Single copies: $3.00 when available. Editor: Margaret Milligan.

Meetings

American Management Association Electronics Conference, and EDP Equipment Exhibit
Date: March 3-5, 1958
Place: New York (Statler Hotel)
Information: American Management Association, 1515 Broadway
Times Square, New York 36, New York

Western Joint Computer Conference
Date: May 6-9, 1958
Place: Los Angeles, California (Ambassador Hotel)
Theme: Contrasts in Computers. The last day will be devoted to Reports from the Manufacturers on small automatic computers and input/output equipment.
Information: Dr. Willis H. Ware, General Chairman, care of Rand Corp. 1700 Main Street, Santa Monica, California

Operations Research Society of America (Annual Meeting)
Date: May 15, 16, 1958
Place: Boston, Massachusetts (Sheraton-Plaza Hotel)

Canadian Computer Conference
Date: June 9, 10, 1958
Place: University of Toronto, Toronto, Canada
Information: H. J. Stowe, Manufacturers Life Insurance, 200 Bloor Street, East, Toronto 5, Ontario, Canada

International Automation Exposition and Congress
Date: June 9-13, 1958
Place: New York (Coliseum)
Information: Richard Rimbach Associates, Show Management, 845 Ridge Avenue, Pittsburgh 12, Pennsylvania

Association for Computing Machinery Annual Meeting
Date: June 11-13, 1958
Place: Urbana, Illinois (University of Illinois)

Instrument Society of America Automation Conference
Date: September 15-19, 1958
Place: Philadelphia, Pennsylvania (Convention Hall)

SHARED PROGRAMING GROUP

USE-- Next Meeting: March 26-28, 1958; Washington, D. C.

Training

Electronic Data Processing for Business and Industry (Course 10), sponsored by Canning, Sisson and Associates

Date: April 14–18, 1958
Place: New York (Hotel Biltmore)
Fee: $250
Program: Emphasis on the applications aspect of electronic data processing, planning for an EDP system
For whom: Management personnel charged with setting up an EDP system
Information: Canning, Sisson and Associates, 1140 South Robertson Blvd., Los Angeles 35, California

Installing an Electronic Data Processing System (Course 20), sponsored by Canning, Sisson and Associates

Date: May 12–16, 1958
Place: New York (Hotel Roosevelt)
Program: Organization, Personnel, Physical Installation, Conversion, Operation of the EDP system are subjects covered. It is desirable, but not required, that attendees have taken Course 10 or its equivalent
Information: Canning, Sisson and Associates, 1140 South Robertson Blvd., Los Angeles 35, California

Operations Research in Production and Inventory Control, sponsored by Case Institute of Technology

Date: June 2–13, 1958
Place: Case Institute, Cleveland, Ohio
Information: R. L. Bell, Engineering Administration Department, Case Institute of Technology, 10900 Euclid Avenue, Cleveland, Ohio

UNIVERSITY AND COLLEGE COURSES

University of California, Los Angeles, Extension Division

Spring Semester: Machine Evaluation of Digital Computers, Application of Digital Computers, Electronic Data Processing: Programing a Business Computer

For information, write to University Extension, University of California, Los Angeles 24, California; or call: BRadshaw 2-6161, Ext. 721.

Stanford University, Dept. of Industrial Engineering

Spring Quarter: Operations Research Seminar, Data Processing Seminar, Computer Laboratory, Data Processing Laboratory, and others.

For information, write to Department of Industrial Engineering, Stanford University, Palo Alto, California

The Pennsylvania State University

Engineering Seminars, Summer, 1958: Digital Design of Electrical Equipment (June 8-14); Introduction to Computer Programing (June 16-21); Automatic Data Processing in Business and Industry (June 23-28); Scientific and Engineering Computation (July 13-25); Mathematical Methods for Management (August 3-8).

Fees: $60.00 for one week; $90.00 for two-week programs.

For information, write to: T. Reed Ferguson, Administrative Head, Extension Conference Center, The Pennsylvania State University, University Park, Pa.

Whittier College, Whittier, California

Spring Semester: Introduction to Digital Computers for Business.

For information, write to Director of Extended Day Classes, Whittier College, Whittier, California

Pasadena City College, Pasadena, California

Spring Semester: Electronic Digital Computing.

For information, write to Extended Day Office, Pasadena City College, 1570 East Colorado Street, Pasadena, California

EDUCATIONAL PROGRAM SPONSORED BY NMAA CHAPTER

The Orange Empire Chapter of the National Machine Accountants Association has inaugurated a program of classes in various colleges in the Pomona-San Bernardino area of California. These range from key-punch classes to courses in electronic data processing. The latter include introductory classes on EDP and programing. For information, write to: Mr. Joseph H. Wolter, 6008 Prospero Drive, Glendora, California.

WESTERN DATA PROCESSING CENTER

The first installation of the new IBM 709 will be made at the Western Data Processing Center at University of California, Los Angeles. This will replace the 705 originally scheduled to be given to the Center by IBM. The new building being built on the campus to house the installation will be completed in June, 1958. The computing center will be used for research and training in business and scientific problems. The Center is a division of the University's Graduate School of Business Administration, and its facilities will be available to business researchers and students from 32 colleges and universities in eleven western states and Hawaii.